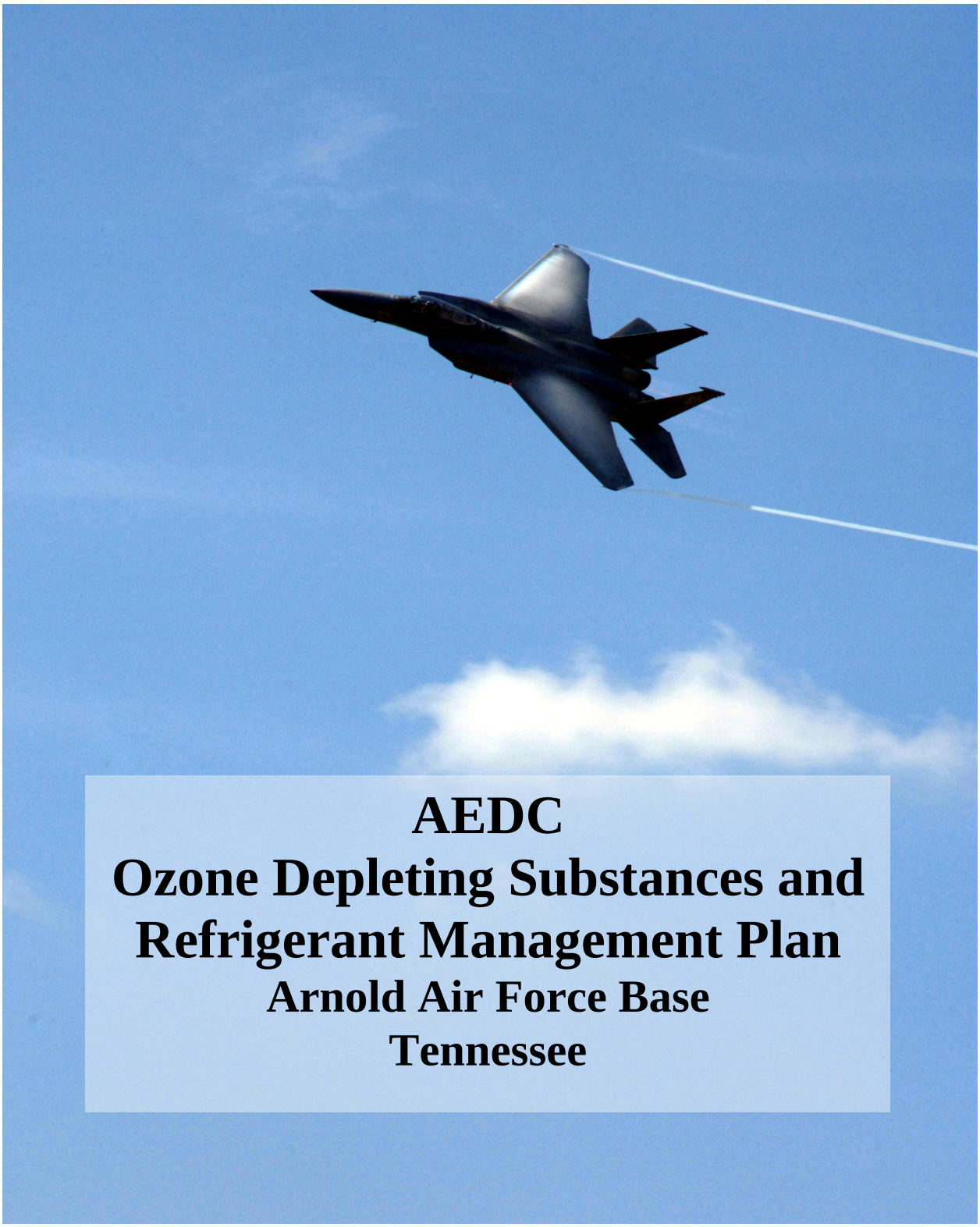

AEDC
Ozone Depleting Substances and Refrigerant Management Plan
Arnold Air Force Base
Tennessee

Revised 10 September 2013

Record of Review/Revision

Date/POC	Description
09/10/13 Philip Sherrill	Updated employee numbers in Section 1.5 Updated Section 3.3 to reflect non-ODS status of all MVACs at AEDC. Updated Section 7.2 to remove requirement of recovering refrigerant from salvage equipment for reuse in AEDC systems. Updated Appendix A – removed 3 units that have been replaced. Updated Appendix D – Unit charge changed to 550
09/05/12 Philip Sherrill	Updated Air Force office symbols throughout. Updated Section 2.0 list of CFC and HCFC applications. Updated Section 3.1.1 to reflect ETF-C process changes. Updated Section 3.3 to better define vehicles with Class II refrigerants. Removed reference to industrial R-12 systems in Section 6.1.1 due to system upgrades in FY12. Reduced the inventory of R-113 in Section 6.1.2. Changed the exemption date for Class I laboratory ODS use in Section 6.1.3.

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Acronyms and Abbreviations

AEDC ..... Arnold Engineering Development Complex
AF ..... Air Force
AFI ..... Air Force Instruction
AFMC ..... Air Force Materiel Command
ASHRAE..... American Society of Heating, Refrigeration, and Air Conditioning Engineers
ASME ..... American Society of Mechanical Engineers
ATA ..... Aerospace Testing Alliance
BCE ..... Base Civil Engineer
CAA ..... Clean Air Act
CFC ..... Chlorofluorocarbon
CFR ..... Code of Federal Regulations
CY ..... Calendar Year
DLA ..... Defense Logistics Agency
DoD ..... Department of Defense
DOT ..... Department of Transportation
EPA ..... Environmental Protection Agency
EQ ..... Environmental Quality
EQID ..... Equipment Identification
ETF ..... Engine Test Facility
FY ..... Fiscal Year
GSA ..... Government Service Agency
HAZMART ..... Hazardous Materials Pharmacy
HCFC ..... Hydrochlorofluorocarbon
HFC ..... Hydrofluorocarbon
HVAC ..... Heating, Ventilation, and Air Conditioning
HQ ..... Headquarters
LOX ..... Liquid Oxygen
MVAC ..... Motor Vehicle Air Conditioner
ODS ..... Ozone Depleting Substance
ODSP ..... Ozone Depleting Substance Program
PFC ..... Perfluorinated Compound
PWT ..... Propulsion Wind Tunnel
RC ..... Refrigeration Cooler
RU ..... Refrigeration Unit
SAO ..... Senior Acquisition Official
SNAP ..... Significant New Alternatives Policy
TCA 1,1,1-Trichloroethane
TCE ..... Trichloroethylene
VKF ..... von Karman Facility

1.0 INTRODUCTION

1.1 Background

The Arnold Engineering Development Complex (AEDC) Ozone Depleting Substances (ODS) Program as defined in the *Ozone Depleting Substances and Refrigerant Management Plan* is formulated and executed with the intent to abide by the letter and spirit of the following legal/statutory requirements:

- *Montreal Protocol Agreements of 1987 and 1990*
- *Omnibus Budget Reconciliation Act of 1989*
- *Comprehensive Environmental Response, Compensation and Liability Act of 1980*
- *Clean Air Act of 1990*
- *Bush Administration Ban on Production of Class I ODSs and Halons*
- *National Defense Authorization Act for Fiscal Year (FY)93*

This plan is reviewed annually and updated as additional regulatory guidance becomes available or as additional regulations are released. AEDC is in compliance with all applicable ODS rules and regulatory requirements.

1.2 Objective

The AEDC ODS and Refrigerant Management Plan provides a blueprint to ensure compliance with Federal and Air Force (AF) requirements and regulations regarding ODSs and refrigerants. The ultimate objective of the ODS and Refrigerant Management Plan is to eliminate releases of ODS to the environment and to reduce dependence on ODSs, while minimizing the impact to the AEDC mission.

1.3 Program Management

Aerospace Testing Alliance (ATA) Environmental Quality (EQ) serves as a consultant to systems engineers, technicians, and management to help insure compliance with Environmental Protection Agency (EPA) regulations, and is responsible for reviewing and updating this plan as required. The AF ODS program manager is responsible for program oversight.

The prime resource for information on all aspects of AF ODS and Refrigerant Management is Air Force Instruction (AFI) 32-7086, *Hazardous Materials Management,* Chapter 4, "Ozone Depleting Substance Management Program." Chapter 4 implements the relevant regulatory drivers, describes the AF Class I and Class II ODS Management approach for both facilities and weapon systems, contains instructions on obtaining the Senior Acquisition Official (SAO) approvals required by law for all AF contracts involving a Class I ODS, and gives an overview of the steps required to requisition Class I ODSs from the AF account at the DoD ODS Defense Reserve.

1.4 Roles and Responsibilities

AEDC has developed a Hazardous Material Management Process (HMMP) Team in accordance with AFI 32-7068, *Hazardous Materials Management,* Section 1.4, “HMMP Team”. It is the responsibility of the members of this team to ensure that a responsible use program is in place; facility air conditioning, refrigeration, and fire suppression systems are properly managed; and that all inadvertent releases of ODS are investigated.

1.5 Facility Background

AEDC is the most advanced and largest complex of flight simulation test facilities in the world. Facilities can simulate flight conditions from sea level to altitudes over 100,000 feet, and from subsonic velocities to those well over Mach 16. There are 442 civilian government employees, 88 military employees and 1,841 contractor employees at AEDC.

Located in southern-middle Tennessee (Coffee and Franklin Counties), midway between Chattanooga and Nashville (Figure 1), AEDC is situated on 40,000 acres with the main testing complex occupying approximately 4,000 acres within Arnold Air Force Base. The base is primarily composed of land formerly occupied by the Camp Forrest United States Army Training Center, conveyed to the Federal Government by the State of Tennessee in the *Public Acts of 1951*.

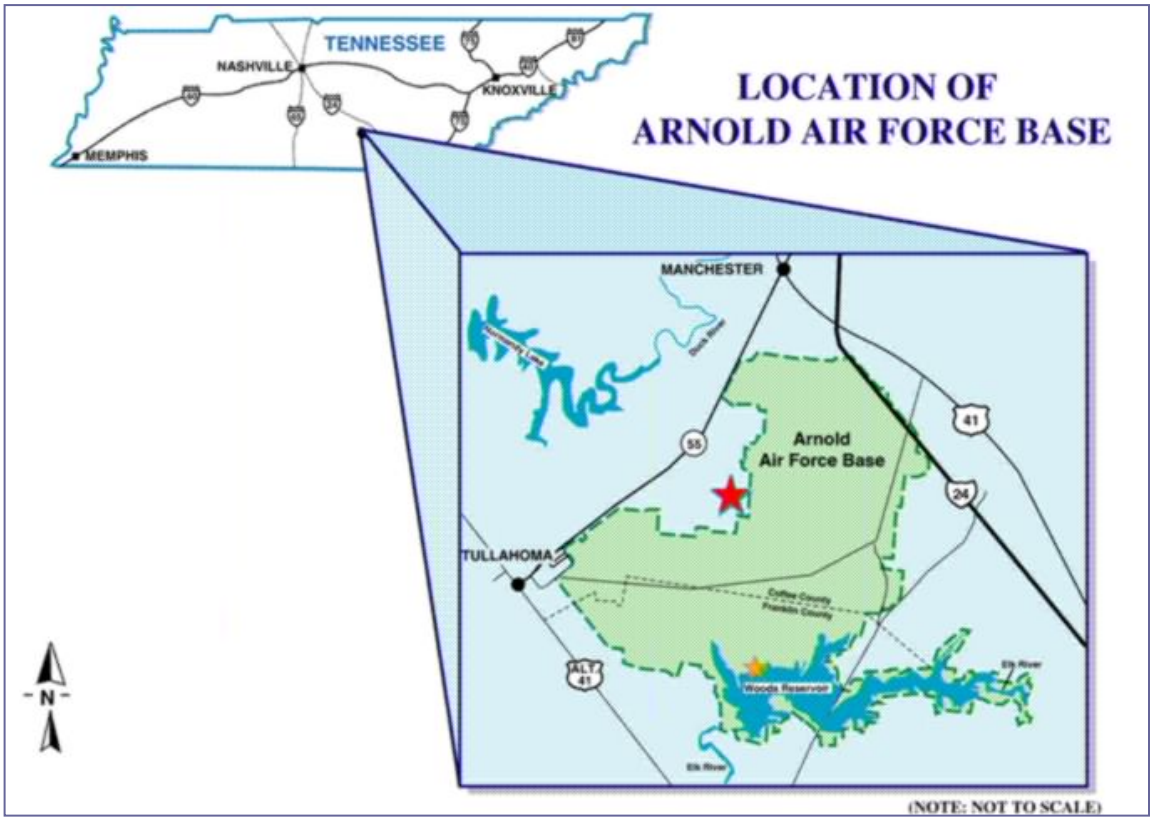

Figure 1 Location Map of Arnold Air Force Base

2.0 ODS APPLICATIONS

Three general types of ODSs are used at AEDC; Refrigerants [chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs)], Fire Suppressants (Halon 1211), and Mission Critical Solvents [carbon tetrachloride and 1-1-1 Trichloroethane (TCA)]. Typical applications of these substances are as follows:

***Refrigerants**:*

CFCs

- Large fixed air conditioning systems (R-12)
- Smaller, older appliances, i.e., ice-making machines and refrigerators (R-12, R-502)

HCFCs

- Large building chillers (R-22, R-123)
- Industrial process refrigerants (R-123)
- Walk-in refrigerators and freezers (R-22)
- Smaller fixed air conditioning systems (R-22)
- Window air conditioners (R-22)

Fire Suppressants:

- Portable (two-wheeled) flightline fire protection (Halon 1211)

Mission Critical Solvents:

- Chemical Laboratory [carbon tetrachloride, 1,1,1-Trichloroethane (TCA)]
- General metal cleaning (R-113)

3.0 REFRIGERATION SYSTEMS

AEDC's refrigeration systems can be divided into three categories: industrial process, facility air conditioning (comfort cooling), and automotive.

3.1 Industrial Process Systems

AEDC industrial process refrigeration systems are located in the following test facilities;

- Engine Test Facility (ETF)
- von Karman Facility (VKF)
- Propulsion Wind Tunnel (PWT)

Each of these test facilities includes multiple industrial process refrigeration systems. Refrigerants used in these systems amount to a total storage inventory of 30,780 tons and a total operating charge of approximately 286,000 pounds.

3.1.1 ETF

The ETF-C Plant has ten open-drive industrial process centrifugal-type chillers designated *RC12.1*, *RC12.2*, *RC13.1*, *RC13.2*, *RC14.1*, *RC14.2*, *RC22.1*, *RC3.1.1*, *RC3.1.2*, and *RC3.2*. The combined capacity of these systems is 23,078 tons. R-134a and ethylene glycol are used in the *RC12*, *RC2*, and *RC3* units. R-507A and Dynalene are used in the *RC13* and *RC14* units. The current ETF-C Plant's operating charge is 150,000 pounds of R-507A, and 63,600 pounds of R-134a. The total charge of the *C*-Plant units can be recovered (placed in storage) to storage tanks permanently installed on the southeast corner of Building 929 and Building 922.

The *RC12*, *RC13*, and *RC14* units are staged to cool 1,100 pps of process air to -24°F in the *RC1* air cooler, and the *RC22* unit cools 350 pps of process air to 38°F in the *RC2* air cooler. The *RC3* units are operated in parallel to cool 900 pps of atmospheric in-bleed air at the *RC3* air cooler.

3.1.2 PWT

PWT Atmospheric Air Dryer #1 (AAD1) operates two Trane centrifugal chillers. The chillers operate either individually or simultaneously and serve as a pre-cool system for the atmospheric drier. This system passes a water/ethylene glycol mixture through the heat exchanger evaporator

coils. Ambient air passed across the coil face of the heat exchanger is cooled which reduces the amount of humidity entering the desiccant drier. The reduction in humidity of the ambient air extends the life of the drier.

PWT Atmospheric Air Dryer #2 (AAD2) houses two 1,280-ton R-123 centrifugal chillers that also serve as a pre-cool system for the atmospheric drier. This system passes a water/propylene glycol mixture through the heat exchanger evaporator coils. The chillers operate either individually or simultaneously.

The total refrigerant charge of a chiller can be recovered (placed in storage) into four portable tanks located in Building 784. Appendix C, *PWT Plant Equipment*, provides additional information on PWT process refrigeration systems.

3.1.3 VKF

Two 300-ton chillers, designated *RU-2A* and *RU-2B*, located in the VKF Compressor Building operate in parallel to provide 38°F chilled ethylene glycol and water brine to dehumidification coils in the VKF compressor facility. Using a process similar to the PWT process described above, these coils pre-dry incoming air to increase desiccant bed life. The base cooling water system is used to cool condensers for these chillers.

Both *RU-2A* and *RU-2B* are equipped with helical rotary compressors charged with R-22. Each of these chillers is designed to meet 90-95% of VKF requirements; therefore, one chiller is normally in operation with the other in standby as a backup or for use when cooling load requirements exceed 300 tons. Appendix D, *VKF Plant Equipment*, provides additional information on VKF process refrigeration systems.

3.1.4 Maintenance

Proper operation and maintenance of industrial process refrigeration equipment plays an important role in reducing ODS emissions. EPA-required service practices are strictly followed during system maintenance and operation. The 30-day leak repair and leak repair verification periods mandated by the EPA serve as AEDC's minimum standard for repairing leaking industrial process refrigeration systems; however, the AEDC policy is to repair refrigerant leaks found during preventive maintenance as soon as possible.

AEDC/TMM is directly responsible for first-level maintenance and operation of the base's industrial process refrigeration systems. The base contractor provides maintenance and operational support for the ETF, PWT, and VKF units. Operations engineers operate the units and provide first-level maintenance (filter changes and leak detection). Pipe fitters, machinists, and instrument technicians perform second-level maintenance (preventative inspections, major mechanical/electrical repairs, and instrument calibrations). The maintenance team and the Mission Operation Control Center (MOCC) schedule second-level preventative maintenance.

3.2 Facility Air Conditioning (Comfort Cooling) Systems

AEDC's comfort cooling systems operate with a combined nominal capacity of approximately 10,000 tons. These systems condition over three million square feet of space, including office facilities and test-critical computer rooms. There are approximately 2,000 facility air-conditioning and refrigeration assets which include air-conditioning systems, conventional refrigeration

systems, special refrigeration systems, and environmental chambers. Appendix A, *EPA Regulated Comfort Cooling Units*, provides a list of comfort cooling equipment which contains 50 pounds or more of a Class I or Class II ODS.

Systems that continue to use R-12 include domestic refrigerators and freezers, water coolers, ice machines, window AC units, and one older package unit. The majority of AEDC's comfort cooling systems operate with Class II ODSs with R-22 being the most common.

3.2.1 Maintenance

The base contractor provides maintenance and operational support for all comfort cooling systems at AEDC. The EPA-required service practices are strictly followed during system maintenance and operation. The 30-day leak repair and leak repair verification periods mandated by the EPA serve as minimum standards for repairing leaking comfort cooling systems; however, AEDC policy is to repair all refrigerant leaks as soon as possible.

3.3 Motor Vehicle Air Conditioning (MVAC) Systems

All AEDC transportation and industrial vehicles are equipped with non-ODS refrigerants. All new vehicles purchased for use at AEDC shall be equipped with non-ODS alternative refrigerants approved by the EPA Significant New Alternatives Policy (SNAP), under Section 612 of the Clean Air Act (CAA).

3.3.1 Maintenance

Contractor-owned MVACs are serviced by certified technicians in accordance with EPA-required service practices using EPA-certified recovery equipment. An off-base contractor provides air conditioning service for AEDC's General Services Administration (GSA) vehicles.

4.0 EPA PROHIBITIONS AND REQUIRED SERVICE PRACTICES

To promote recycling or reclamation of refrigerants and help lower the risk of depletion of the stratospheric ozone layer and the possibility of global climate change, thus diminishing potentially harmful effects to human health and the environment, 40 CFR Part 82, *Protection of the Stratospheric Ozone Layer*, prohibits certain actions and prescribes required service practices for personnel engaged in repair and maintenance of refrigeration appliances.

4.1 Prohibition on Venting

No person maintaining, servicing, repairing, or disposing of appliances may knowingly vent or otherwise release into the environment any Class I or Class II substance used as a refrigerant (40 CFR 82.154). The CAA, Title VI Section 608 paragraph (c)(2), extends the prohibition on venting to substitute refrigerants, including hydroflourocarbon (HFC) and perfluorinated compound (PFC) refrigerants.

4.1.1 Known Venting

Known venting is defined by the EPA as any release that permits a refrigerant to enter the environment and that takes place with the knowledge of the technician during the maintenance, service, repair, or disposal of air-conditioning or refrigeration equipment. *Known venting* does not prohibit "topping off" systems, which leads to emissions of refrigerant during the use of equipment. The provision for *known venting*, however, does include situations in which a technician is practically certain that his/her actions will cause a release of refrigerant during the maintenance, service, repair, or disposal of equipment. It also includes situations in which the technician shields him or herself from *obvious facts* or fails to investigate when aware of facts that should dictate an investigation.

4.1.2 De minimus Releases

De minimus releases are associated with good faith attempts to recycle or recover refrigerants. These are minimal releases that may occur when EPA-required practices are observed and EPA-approved recovery or recycling machines are used. *De minimus* releases are not subject to the prohibition on *known venting*. Small releases of refrigerant that result from purging hoses or from connecting or disconnecting hoses to charge or service appliances will not be considered violations of the prohibition on venting. However, recovery and recycling equipment manufactured after November 15, 1993 must be equipped with low-loss fittings.

4.1.3 Accidental Releases

Accidental refrigerant releases are refrigerant releases not associated with mechanical failures of a unit. Human-caused accidental damage to a refrigerant line, such as a forklift or nail penetration, would be considered accidental. Excessive vibration in a unit, which leads to line rupture, would not be an accidental release.

4.1.4 Releases of ODSs Not Used as Refrigerants

Mixtures of nitrogen and ODSs that are used as holding charges or as leak test gases may be released, because in these cases, the ODS is not used as a refrigerant. However, a technician may not avoid recovering refrigerant by adding nitrogen to a charged system; before nitrogen is added, the system must be evacuated to the appropriate level as shown in Appendix E; otherwise, the ODS vented along with the nitrogen will be considered a refrigerant.

4.1.5 AEDC ODS Venting Policy

AEDC has adopted a ***no vent*** policy for all refrigerants and documents all refrigerant usage for maintenance, service, repair, and disposal on a *Refrigerant Transaction Summary* to demonstrate that refrigerants are not vented.

4.2 Leak Repair Practices

Leaks in refrigerant equipment with charges >50 pounds are required to be repaired when those leaks would result in the loss of more than a certain percentage of the equipment's charge over a year. For the commercial and industrial process refrigeration sectors, leaks must be repaired when the appliance leaks at a rate that would release 35 percent or more of the charge over one year. For all other sectors, including comfort cooling, leaks must be repaired when the appliance leaks at a rate that would release 15 percent or more of the charge over one year.

The trigger for repair requirements is the current leak rate rather than the total quantity of refrigerant lost. For instance, owners of a commercial refrigeration system containing 100 pounds of charge must repair leaks if they find that the system has lost 10 pounds of charge over the past month; although 10 pounds represents only 10 percent of the system charge in this case, a leak rate of 10 pounds per month would result in the release of over 100 percent of the charge over the year. To track leak rates, owners of air-conditioning and refrigeration equipment with more than 50 pounds of charge must keep records of the quantity of refrigerant added to their equipment during servicing and maintenance procedures.

Leak repairs shall be completed within 30 days of discovery of the leak. This requirement is waived if, within 30 days of discovery, owners develop a one-year retrofit or retirement plan for the leaking equipment. Owners of industrial process refrigeration equipment may qualify for additional time under certain circumstances. For example, if an industrial process shutdown is required to repair a leak, owners have 120 days to repair the leak.

4.2.1 Leak Repair Verification

When a refrigeration system shutdown has occurred or when repairs have been made while an appliance is mothballed, an initial verification test shall be conducted at the conclusion of the repairs, and a follow-up verification test shall be conducted within 30 days of completing the repairs or within 30 days of bringing the appliance back on-line, if taken off-line, but no sooner than when the system has achieved normal operating characteristics and conditions. When repairs have been conducted without a shutdown or system mothballing, an initial verification test shall be conducted at the conclusion of the repair efforts, and a follow-up verification test shall be conducted within 30 days after the initial follow-up verification test. In all cases, the follow-up verification test shall be conducted at normal operating characteristics and conditions unless sound professional judgment indicates that tests performed at normal operating characteristics and conditions will produce less reliable results, in which case the follow-up verification test shall be conducted at or near the normal operating pressure where practicable, and at or near the normal operating temperature if practicable, and within 30 days of completing the repair efforts.

If industrial process refrigeration equipment is taken off line, it cannot be brought back on-line until an initial verification test indicates that repairs have been successfully completed, demonstrating that all leaks are repaired or where the owners or operators of the industrial process

refrigeration equipment have developed a plan to retrofit/replace/retire the industrial process refrigeration equipment in accordance with 40 CFR Part 82.

If the follow-up verification test indicates that the repairs to industrial process refrigeration equipment have not been successful, the owner must retrofit or replace the equipment within one year after the failed follow-up verification test.

The owner or operator of industrial process refrigeration equipment that fails a follow-up verification test must notify EPA within 30 days of the failed follow-up verification test in accordance with §82.166(n).

Violations of EPA regulations and requirements can result in fines up to $32,500 per day, per violation. Intentional violations can result in criminal penalties of up to five years imprisonment. Submission of false or misleading information or failure to submit required records can result in criminal penalties, including two years imprisonment.

4.2.2 AEDC Leak Repair Policy

It is the policy of AEDC to repair all identifiable ODS leaks, regardless of total charge; however, when a refrigerant transaction for a system whose total charge exceeds 50 pounds is entered into the ODS database, an annualized leak-rate must be calculated. The method for calculating an annualized leak rate is:

$$\text{Leak Rate \%} = \left[\frac{\text{pounds of refrigerant added}}{\text{pounds of full charge}}\right] x \left[\frac{365 \text{ days}}{\text{shorter of : \# of days since refrigerant last added or 365 days}}\right] x\ 100$$

When the annualized leak-rate exceeds the maximum allowable leak rate, 15% (comfort cooling) or 35% (industrial process), HAZMART personnel (comfort cooling) or system engineers (industrial process) must initiate the following actions:

a. Immediately notify AEDC Operations Center and ATA/EQ of the leak
b. Issue a Synergen® work request for unit repair or leak-repair follow-up action

ATA Management System Procedure P05-3003, *Control of Ozone Depleting Substances – Comfort Cooling*, and AEDC SHE Standard E-14, *Ozone Depleting Substances*, provide instructions on preparing a work request for repair or 30-day follow-up leak-repair verification, and for follow-up on work request status.

4.3 Recovery/Recycling Practices

EPA has established that refrigerant recovered and/or recycled can be returned to the same system or other systems owned by the same person without restriction. If refrigerant changes ownership, however, that refrigerant must be reclaimed.

40 CFR, §82.156 establishes the EPA recovery/recycling requirements. These requirements are also included in ATA Management System Procedure P05-3003, *Control of Ozone Depleting Substances – Comfort Cooling*, Sections 6.1 and 6.2.

4.3.1 Evacuation Levels

Air-conditioning and refrigeration equipment must be evacuated to EPA-required vacuum levels prior to opening (Appendix E). If the technician's recovery or recycling equipment was manufactured on or after November 15, 1993, then an EPA-approved equipment testing organization must certify the equipment. Refrigerant recovery and recycling equipment manufactured before November 15, 1993, may be grandfathered if it meets the standard detailed in 40 CFR 82.158. Persons who simply add refrigerant to (top-off) appliances are not required to evacuate the systems.

4.3.2 Equipment Certification

EPA has established a certification program for refrigerant recovery and recycling equipment. EPA requires that persons servicing or disposing of air-conditioning and refrigeration equipment certify to the EPA that they have acquired (built, bought, or leased) recovery or recycling equipment and that they are complying with the applicable requirements of this rule. Owners do not have to send in a new form each time they add recycling or recovery equipment to their inventory.

AEDC has submitted the appropriate Recovery/Recycle Equipment Certification forms as required by EPA. Copies of these forms are on file at the HAZMART ODS Center.

4.3.3 Technician Certification

Technicians servicing air conditioning and refrigeration equipment shall be EPA-certified for the type of work performed. Section 8.0 of this document, *Training*, describes technician certification requirements.

4.3.4 Proper Use of Recovery/Recycling Equipment

EPA defines proper use of recovery and recycling equipment to mean using such equipment in conformity with the regulations of 40 CFR 82 Subpart B, to include the prohibitions. In addition, the technician must follow the recommended service procedures and practices for the containment of refrigerant set forth in 40 CFR 82 Subpart B appendices A, B, C, D, E, and F, as applicable. The term also includes operating the equipment in accordance with the manufacturer’s guide to operation and maintenance and using the equipment only for the controlled substance for which the machine was designed.

4.4 Record Keeping Practices

One of the most detailed requirements set forth by the EPA for compliance with the CAA deals with record keeping. Incorrect records and documentation can lead to violations and fines from the EPA.

Included in the EPA’s requirements for record keeping are:

- Persons disposing of refrigeration equipment must maintain records verifying all refrigerants have been removed

- Persons servicing equipment containing over 50 pounds refrigerant must keep servicing records indicating date of service, type of service, and the quantity of refrigerant added

- Owners of refrigeration equipment must keep records of refrigerant purchased and added to each appliance, including date of service

- Owners of refrigeration equipment must keep records of leak rate calculations and determinations for equipment containing over 50 pounds of refrigerant per circuit

- Leaking refrigeration equipment must be repaired within 30 days of leak discovery or a written one year retirement plan for the leaking equipment must be developed and kept on-site

- Owners of refrigeration equipment must keep records of refrigerant purchased and added to each appliance to determine leak rates

- Technicians certified under §82.161 must keep a copy of their certificate at their place of business

- Records must be maintained for a minimum of three years

If a leaking ODS system cannot be repaired within 30 days of leak discovery, owner/operators are required to submit an initial report to the EPA regarding why more than 30 days are needed to complete repairs. The report must include:

- Identification of the facility
- The annualized leak rate
- The method used to determine the leak rate and full charge
- The date a leak rate above the applicable leak rate was discovered
- The location of leak(s) to the extent determined to date
- Any repair work that has been completed thus far and the date that work was completed
- The reasons why more than 30 days are needed to complete the work and an estimate of when the work will be completed

If changes from the original estimate of when work will be completed result in extending the completion date from the date submitted to EPA, the reasons for these changes must be documented and submitted to EPA within 30 days of discovering the need for such a change. Copies of all correspondence to the EPA should be kept on-site for a minimum of three years.

5.0 AEDC ODS MANAGEMENT CENTERS

HVAC and HAZMART personnel conduct comfort cooling ODS recordkeeping activities in two facilities, the HAZMART ODS Center (Building 1459) and the ODS Recycling Center (Building 1424). Storage and inventory of comfort cooling ODS maintained at the HAZMART ODS Center only. Records of refrigeration usage for AEDC's industrial process systems are managed and maintained by system engineers for each of the base's industrial process systems, ETF, PWT, and VKF.

5.1 HAZMART ODS Center

Proper ODS storage and inventory practices are important for minimizing ODS emissions and refrigerant contamination, as well as for maximizing ODS resource management. The HAZMART ODS Center plays a pivotal role in managing AEDC's ODS refrigerant working inventory.

Comfort cooling refrigerant inventory is managed, and usage is tracked, by personnel at the HAZMART ODS Center. Refrigerants stored at the HAZMART ODS Center are; R-12, R-123, R-13, R-22, R-23, R-134A, R-402B, R-404A, R-410A, R-420A, R-422D, R-500, and R-502.

The HAZMART ODS Center also serves as a storage site for VKF's inventory of R-22 refrigerant; however, HAZMART ODS personnel are not responsible for keeping records of VKF refrigerant usage. (Managing and maintaining refrigerant usage records for each of the industrial process systems, ETF, PWT, and VKF, is the responsibility of system engineers.)

ODS refrigerants are issued to HVAC technicians through use of a *Refrigerant Transaction Summary* form. The technician is required to record the cylinder number and the weight of each cylinder checked out. Once a job is complete, the cylinders are re-weighed to determine the amount of refrigerant used. Unit information, a description of the repair work, the technician's comments, and technician's signature are entered to complete the form.

Data from completed transaction summaries is entered into the ODS database. Hardcopies are filed in the building folder and maintained for a minimum of three years. A physical inventory of refrigerants on hand is conducted monthly to track usage and to verify the accuracy of records.

Refrigerant loss from any unit having a charge greater than 50 pounds requires a leak rate calculation and completion of a leak rate calculation form. If the annualized rate of leakage exceeds the allowable leak rate (15% of the total unit charge for comfort cooling; 35% of the total unit charge for industrial process units), a work request is entered into Synergen, requesting leak repair verification within 30 days of the repair completion date. This is commonly referred to as a 30-day follow-up leak repair verification. Leak rate reports and 30-day follow-up leak repair verification reports are filed in the building folder. In accordance with EPA record keeping requirements, all ODS records must be maintained for a minimum of three years.

ODS Center personnel ensure that the inventory of ODS containers meets applicable EPA regulations, Department of Transportation (DOT) requirements, and American Society of Mechanical Engineers (ASME) standards. All containers are uniquely numbered to facilitate inventory management. Transactions are updated daily in a ledger recordkeeping system, and tags on cylinders are updated during monthly inventory.

EPA-required records, documents and copies of HVAC technician certifications are maintained at the HAZMART ODS Center. The Center is manned from 0700-1530 hours Monday through Friday, and an alternate supply person is available as needed for weekend and holiday transactions.

5.2 ODS Recycling Center

Small ODS containing appliances (refrigerators, water coolers, small air conditioners, etc.) are salvaged and ODSs recovered at the ODS recycling Center. ATA Management System

Procedure P05-3003, *Control of Ozone Depleting Substances – Comfort Cooling*, documents the process and requirements for recovering refrigerants and managing salvaged refrigeration equipment in accordance with EPA requirements. The ODS Recycling Center is also the storage and maintenance area for AEDC's certified ODS recovery equipment.

6.0 AEDC ODS REDUCTION/ELIMINATION PLAN

The purpose of this section is to manage AEDC's continuing use of ODSs; to reduce reliance on ODSs; and to eventually eliminate all ODS requirements. Proper ODS management will:

- Minimize the risks to mission capability
- Minimize cost to AEDC
- Eliminate AEDC usage of Class I and Class II ODSs when there is a validated alternative that does not increase environmental, safety, and health risks and costs.

6.1 Class I ODS

By international agreement, all Class I ODS production effectively ended on 31 December 1995. Because of this, continued reliance on Class I ODS usage presents potential risks to AEDC mission capability and costs. It is critical that AEDC effectively manage these risks.

The AF Class I ODS Management Program (Section 4.4, AFI 32-7086) includes five key elements which are:

- **AF Form 3952 Authorization Process** - As a Hazardous Material, Class I ODS usage requires prior approval through the AF 3952 Authorization Process. An AF 3952 for a Class I ODS cannot be approved unless the requestor can provide documentation that specifies exclusive use of a Class I ODS.
- **DLA Class I ODS Defense Reserve Stockpile Management** – Procurement of Class I ODS must be from the DLA (Defense Logistics Agency) Class I ODS Defense Reserve and cannot be purchased on the commercial market. This supply is only available for mission critical weapon system requirements. Installation Class I ODS halon fire suppression and refrigerant air conditioning systems must rely on internal supplies of halon and refrigerants and cannot access the DLA Class I ODS Defense Reserve. AEDC Class I refrigerant and fire suppression stockpiles are discussed in Sections 6.1.1 and 6.1.4 respectively.
- **Prohibition on Requirements for Contractors to use Class I ODS** – No project or activity can include in the solicitations or contracts any specifications that require the use of a Class I ODS. In addition, solicitations for services or products must include AFFARS clause 5352.223-9000 which prohibits contractors from providing any service or product that requires the use of a Class I ODS.
- **SAO Approval Process** – An Air Force organization must have a valid Class I ODS SAO approval before 1) awarding a contract that requires the use of a Class I ODS, or 2) when obtaining Class I ODS from the DLA Class I ODS Defense Reserve. AEDC procurement requirements are discussed in Section 8.

- **Metrics** – The HQ USAF HMMP team will require specific metric data from installations with Class I ODS weapons systems to determine the adequacy of the DLA Class I ODS Defense Reserve.

6.1.1 Refrigerants

One regulated Class I ODS refrigeration system (> 50 pound total charge) remains in AEDC inventory. The system is an R-12 comfort cooling system servicing the Model Shop (Building 451) Jig-bore Room and is scheduled for replacement in FY15. Domestic production of CFCs ended in 1995; therefore, continued operation of this system is dependent upon existing inventories of Class I refrigerants. There will be no new procurements of Class I ODSs or systems requiring Class I ODSs. Class I refrigerant inventory is maintained at the ODS HAZMART (comfort cooling). The current R-12 inventory (approximately 4 pounds) may not be sufficient for the remaining life of this system.

6.1.2 Mission Critical Solvents

Usage of mission-critical Class I ODS solvents at AEDC is restricted to two applications:

- Liquid Oxygen (LOX) system cleaning/final flushing and verification using R-113
- Laboratory and analytical use of 1,1,1-Trichloroethane (TCA) and carbon tetrachloride

The inventory of R-113 has been reduced to approximately one quart at the chemical cleaning facility. An R-113 substitute, HFE-7100, is now being used almost exclusively for the LOX cleaning application. There will be no new procurements of ODSs for LOX cleaning/final flushing and verification.

6.1.3 Laboratory and Analytical ODS

Laboratory and analytical use of TCA and carbon tetrachloride is anticipated to continue for the foreseeable future. Effective 9 December 2011, the EPA issued an extension of the laboratory and analytical use exemption for essential Class I ODSs. This exemption allows production and importation of Class I ODS for essential laboratory and analytical uses until 31 December 2014. Class I ODSs will be purchased in minimal quantities to support laboratory and analytical operations.

6.1.4 Fire Suppressants

Halon 1211 is the only remaining ODS fire suppressant in use at AEDC. All installed AEDC Halon systems have been decommissioned.

Wheeled Halon 1211 extinguishers are limited in use to the flight line and engine test cell areas. All handheld Halon 1211 extinguishers have been replaced with dry chemical fire extinguishers. Approximately 2100 pounds of Halon 1211 has been turned in to the Defense Logistics Agency as excess. The present supply of Halon 1211 is limited to approximately 900 pounds contained in six (six) 150 pound flightline extinguishers. Usage of Halon 1211 is limited only to amounts discharged from extinguishing fires or from leaks in defective extinguishers.

In accordance with the AF Class I ODS Program, any excess amounts of Class I ODS Halon must be returned to the Defense Logistics Agency (DLA) Defense Reserve for recovery, reclamation, and redistribution.

6.2 Class II ODS

By international agreement, all Class II ODS production levels as of 01 January 1996 became the *base levels* from which incremental reductions will occur until all Class II ODS production has ceased on 01 January 2030. Table 6.1 provides a schedule of Class II production phase-out dates.

Table 6.1 Class II ODS Production Phase-Out

Date	Class II ODS Production Phase-out
01 January 2004	35%
01 January 2010	65%
01 January 2015	90%
01 January 2020	99.5%
01 January 2030	100% (all Class II ODS production must cease)

The AF Class II Management Program (Section 4.8, AFI 32-7086) includes a prohibition on new Class II ODS requirements. The key elements of the program are:

- **AF Form 3952 Authorization Process** - As a Hazardous Material, Class II ODS purchases require prior approval through the AF 3952 Authorization Process.
- **Prohibition on New Class II ODS Requirements** - The AF will not develop, procure, or modify any facility systems that require Class II ODSs in operation or maintenance if that system is scheduled to remain in AF inventory beyond 01 January 2020. The AF will not centrally stockpile Class II ODSs to support continuing requirements after the phase-out of Class II production in the United States.

The Base Civil Engineer has approval for exceptions to the Class II ODS Policy for installation or Real Property air conditioning and refrigeration equipment provided the exception is in accordance with Sections 4.8.2.2.1 - 4.8.2.2.3 of AFI 32-7086.

The AEDC Class II ODS Management Plan consists of the following elements in addition to the above noted elements of the AF Class II ODS Management Program:

- ***Conversion/Replacement*** - Class II ODS refrigeration systems shall be replaced with non-ODS systems as they approach the end of their life-cycle. Note: EPA regulations regarding repairs of equipment with substantial recurring leaks may alter conversion/replacement priorities. Poorly-performing or low-efficiency Class II ODS systems shall be evaluated and may be given priority for replacement.
- ***Specify Alternative Refrigerants*** - When selecting new refrigeration equipment, alternative non-ODS refrigerants must be specified. In order to increase availability of non-ODS refrigerants and disseminate information on non-ODS alternatives, the EPA initiated the SNAP program. The EPA publishes updates to the SNAP list as new substitutes are developed and approved.

  HFCs are gaining acceptance as product substitutes for ODSs. Although HFCs contain no ozone-harming chlorine, they have high global warming potential. Other fluorinated solvents, hydrocarbon-based substances and some aqueous-based products are also being successfully used in place of ODSs.
- ***Limit the Number of Refrigerants Utilized*** - Standardizing and limiting refrigerant types will save time and reduce maintenance and inventory costs. The refrigerant manager and

system engineers shall work as a team to determine what refrigerants are presently in use and set standards for all future refrigerant equipment purchases.

- ***Ensure that all New Equipment is Properly Inventoried*** - All new refrigeration equipment shall be tagged with equipment identification (EQID) numbers, and HVAC personnel shall ensure that new equipment data is provided to the HAZMART ODS Center. ODS Center personnel are responsible for entering equipment data into the refrigerant management database.
- ***Provide for Continuing Class II Refrigerant Requirements beyond 2020*** – In accordance with AFI 32-7086 Section 4.8.2.2.1, Base Civil Engineering shall make an assessment of the inventory of Class II refrigerants that must be maintained to support existing air conditioning or refrigeration equipment without HQ USAF-supplied Class II ODSs. This assessment must be used to develop and implement a detailed plan for supporting Class II ODS usage requirements beyond 2020.

7.0 CONSERVATION EFFORTS

7.1 EPA Requirements

Section 4.0 of this document, *EPA Prohibitions and Required Service Practices*, describes conservation efforts necessary to comply with EPA requirements, i.e., maximum allowable leak rates, leak repair practices, equipment certification, technician certification, and venting prohibitions.

7.2 AF Requirements

AF policy governing the conservation and use of refrigerants dictates the following requirements:

- An AF waiver is required to purchase Class I ODS refrigerants
- Purchasing new facility systems that require Class I ODSs is prohibited.
- Purchasing new facility systems that require Class II ODSs in their operation or maintenance is prohibited if that system is scheduled to remain in AF inventory beyond 01 January 2020
- Class I refrigerants cannot be sold or transferred outside the DoD with the exception of burnt refrigerant for recycling
- The base's refrigerant inventory must be managed so existing equipment can be maintained until the end of its economic life.

7.3 Base Civil Engineer (BCE) Requirements

A leak detection program should be developed to match each piece of refrigeration equipment (high pressure; low pressure; operating; idle) with a specific type of leak detection. A leak-check schedule should also take into account the equipment's past leak history; the greater the equipment's history of leaks, the more frequently it should be leak-checked.

During inspections, leak-prone areas of the system should be checked for integrity. These areas include all penetrations into the refrigerant-containing area and all non-welded connections. Specific areas include:

- Motor terminals
- Sight glasses
- Shaft seals

- Schrader valves
- Solenoid and relief valves
- Flare fittings
- Joints with gaskets
- Filter dryers

8.0 PROCUREMENT

ODSs shall be obtained only through the AEDC HAZMART, which requires an approved AF 3952. An AF 3952 for a Class I ODS cannot be approved unless it identifies a requiring document that specifies the exclusive use of a Class I ODS. The DLA Class I ODS Defense Reserve is the only AF-approved source for obtaining Class I ODSs, and issuance of stockpiled Class I ODSs from the Defense Reserve must be authorized by Ozone Depleting Substance Program (ODSP) SAO Authority. AF SAO authority also applies to the approval of Class II ODS requirements beyond 2020.

AFI 32-7086, *Hazardous Materials Management*, Section 4B, describes in detail the ODSP Structure and SAO authorization requirements.

9.0 TRAINING

Training and education in proper refrigerant management practices and handling techniques is the most effective way to prevent violation of EPA regulations and minimize emission and contamination during refrigerant handling.

Information from the following sources is used to verify certification and refrigerant training:

- EPA certificates (copies maintained at ODS HAZMART)
- PeopleSoft training records

9.1 ODS Technicians

Technicians servicing air conditioning and refrigeration equipment shall be EPA-certified for the type of work performed. ODS technicians may attain EPA certifications as follows:

- TYPE I, Small Appliances--Authorized to service small appliances such as units with 5-lbs or less refrigerant in a hermetically-sealed unit
- TYPE II, High and Very High Pressure Appliances--Authorized to service high and very high pressure appliances (except small appliances and motor vehicle A/C units) such as units that use CFC-12, CFC-114, CFC-502, or HCFC-22
- TYPE III, Low Pressure Appliances--Authorized to service low pressure appliances such as units that use CFC-11, CFC-113, or HCFC-123
- UNIVERSAL CERTIFICATION--Authorized to service Type I, II and III equipment
- MOTOR VEHICLE SERVICE--Authorized to service motor vehicle A/C units

Only ODS technicians with EPA approved certification are authorized to service, maintain, or repair ODS containing appliances.

An ODS technician is any person who performs maintenance, service or repair to air conditioning or refrigeration equipment and could reasonably be expected to release ODS substances into the

atmosphere. Performing maintenance, service, repair, or disposal can reasonably be expected to release refrigerants only if the activity is reasonably expected to violate the integrity of the refrigerant circuit. Activities reasonably expected to violate the integrity of the refrigerant circuit include activities such as 1) attaching and detaching hoses and gauges to and from the appliance/equipment to add or remove refrigerant or to measure pressure and 2) adding refrigerant to and removing refrigerant from the appliance/equipment.

Activities such as painting the appliance/equipment, re-wiring an external electrical circuit, replacing insulation on a length of pipe, or tightening nuts and bolts on the appliance/equipment are not reasonably expected to violate the integrity of the refrigerant circuit. Performing maintenance, service, repair, or disposal of an appliance/equipment that has been evacuated according to EPA requirements is not reasonably expected to release refrigerants from the appliance/equipment unless the maintenance, service, or repair consists of adding refrigerant to the appliance/equipment.

9.2 HAZMART ODS Center Personnel

One of the most detailed requirements set forth by the EPA for compliance with the CAA deals with record keeping procedures. HAZMART ODS Center personnel play a pivotal role in managing AEDC's inventory of comfort cooling refrigerants and maintaining refrigerant usage records in accordance with EPA regulations. HAZMART ODS personnel are required to track refrigerant consumption by each piece of comfort cooling equipment, maintain equipment repair records, and manage HAZMART ODS inventory.

Incorrect records and documentation can lead to violations and fines from the EPA; therefore, HAZMART ODS personnel are required to have a working knowledge of the EPA's recordkeeping requirements for regulated refrigerants.

9.3 Additional Training

Specialized training designed to correspond with the introduction of new equipment and refrigerants to the workplace shall be conducted by HVAC engineers as needed.

Appendix A
EPA-Regulated Comfort Cooling Units

EPA-Regulated Comfort Cooling Units

Refrigerant	Building	Location	EQID	Total Charge (lbs)	Installation Date
R-12	451	JIG BORE ROOM	851	227	
R-22	1075	MECH RM FLOOR 1B	107	129	1987
R-22	1075	MECH RM FLOOR 1B	111	129	1987
R-22	1077	4TH FLOOR MARK 1 TEST	004825	200	
R-22	1411	Control Room	101084	77	
R-22	1476	N. OFFICES EQ RM	005925	76	1991
R-22	1478	SHOP CAGE	005760	106	
R-22	1525	S Equipment Room	005918	54	
R-22	1525	NORTH EQUIPMENT ROOM	005920	80	
R-22	251	North Outside	109807	58	1998
R-22	2912	Equipment Room	006293	53	
R-22	2912	GOSSICK LEADERSHIP CENTER	101145	67	1985
R-22	3017	BASEMENT	101184	144	1998
R-22	350	AIR COOLED CHILLER B	010542	260	1993
R-22	350	EAST EQ RM	100921	355	1998
R-22	451	EQUIPMENT ROOM	796	60	
R-22	520	New Equipment Room	008746	55	
R-22	541	WEST EQUIPMENT RM.	109946	53	
R-22	541	SL206 EQUIPMENT RM.	109947	120	
R-22	541	SL306 EQUIPMENT RM.	109948	120	
R-22	676	MTL NORTH OFFICE	001982	80	
R-22	676	MTL BLDG.	100404	456	1997
R-22	678	S Equipment Room	002319	73	1990
R-22	740	MID EQUIPMENT ROOM	003234	122	2004
R-22	740	RM 108 CMPTR RM	003268	120	2004
R-22	740	COMPUTER ROOM	003329	150	2004
R-22	878	AC&T CONTROL ROOM	003239	55	
R-22	912	NORTH EAST SIDE, OUTSIDE	004464	460	1988
R-22	912	C-1 CONTROL ROOM NORTH SIDE	010558	76	
R-22	912	ASTF TEST BLDG. OUTSIDE	100314	276	1995

Appendix B
ETF Plant Equipment

ETF-C Plant Equipment

Unit	Mfr.	Rating (Tons)	Primary Refrigerant	Charge (Lbs.)	Process	Design Process Temp (°F)
Refrigeration Cooler (RC)12.1	Carrier	3,300	R-134a	13,800	Low-Stage Cooler	38
RC12.2	Carrier	3,300	R-134a	13,800	Low-Stage Cooler	38
RC13	Carrier	4,116	R-507A	70,000	Low-Stage Cooler	0
RC14	Carrier	2,492	R-507A	80,000	Low-Stage Cooler	-24
RC22.1	Carrier	3,300	R-134a	13,800	High-Stage Cooler	38
RC3.1.1	York	1,470	R-134a	4,100	Atmospheric Cooler	36
RC3.1.2	York	1,470	R-134a	4,100	Atmospheric Cooler	36
RC3.2	Carrier	3,500	R-134a	14,000	Atmospheric Cooler	38
Total:		**22,948**	**R-507A** **R-134a**	**150,000** **63,600**		

Appendix C
PWT Plant Equipment

PWT Plant Equipment

Unit	*Mfr.*	*Rating (Tons)*	*Primary Refrigerant*	*Charge (Lbs.)*	*Process*	*Design Process Temp (°F)*
AAD1 Chiller 1	Trane	1060	R-123	1,790	Process Air Dehumidification	38
AAD1 Chiller 2	Trane	910	R-123	1500	Process Air Dehumidification	38
AAD2 Chiller 1	Trane	1,280	R-123	1,850	Process Air Dehumidification	38
AAD2 Chiller 2	Trane	1,280	R-123	1,850	Process Air Dehumidification	38
Totals		**4,530**		**6,990**		

Appendix D
VKF Plant Equipment

VKF Plant Equipment

Unit	Mfr	Rating (Tons)	Primary Refrigerant	Charge (Lbs.)	Process	Design Process Temp (°F)
RU-2A	Trane	300	R-22	550	Process Air Dehumidification	38
RU-2B	Trane	300	R-22	550	Process Air Dehumidification	38
Total		**600**		**1100**		

Appendix E
EPA-REQUIRED LEVELS OF EVACUATION

REQUIRED LEVELS OF EVACUATION FOR APPLIANCES EXCEPT FOR SMALL APPLIANCES, MVACS, AND MVAC-LIKE APPLIANCES		
Type of Appliance	**Inches of Mercury Vacuum* Using Equipment Manufactured:**	
	Before Nov. 15, 1993	**On or after Nov. 15, 1993**
HCFC-22 appliance** normally containing less than 200 pounds of refrigerant	0	0
HCFC-22 appliance** normally containing 200 pounds or more of refrigerant	4	10
Other high-pressure appliance** normally containing less than 200 pounds of refrigerant (CFC-12, -500, -502, -114)	4	10
Other high-pressure appliance** normally containing 200 pounds or more of refrigerant (CFC-12, -500, -502, -114)	4	15
Very High Pressure Appliance (CFC-13, -503)	0	0
Low-Pressure Appliance (CFC-11, HCFC-123)	25	25 mm Hg absolute

* Relative to standard atmospheric pressure of 29.9" Hg
** Or isolated component of such an appliance

Technicians repairing small appliances, such as household refrigerators, window air conditioners, and water coolers, must recover:

80 percent of the refrigerant when

- the technician uses recovery or recycling equipment manufactured before November 15, 1993, or
- the compressor in the appliance is not operating;

OR

90 percent of the refrigerant when

- the technician uses recovery or recycling equipment manufactured after November 15, and
- the compressor in the appliance is operating

In order to ensure that they are recovering the correct percentage of refrigerant, technicians must use the recovery equipment according to the directions of its manufacturer. Technicians may also satisfy recovery requirements by evacuating the small appliance to four inches of mercury vacuum.

EPA has established limited exceptions to its evacuation requirements for 1) repairs to leaky equipment and 2) repairs that are not major and that are not followed by an evacuation of the equipment to the environment.

If, due to leaks, evacuation to the levels in the above table is not attainable, or would substantially contaminate the refrigerant being recovered, persons opening the appliance must:

- isolate leaking from non-leaking components wherever possible;
- evacuate non-leaking components to the levels in the above table; and
- evacuate leaking components to the lowest level that can be attained without substantially contaminating the refrigerant. This level cannot exceed 0 psig.

If evacuation of the equipment to the environment is not to be performed when repairs are complete, and if the repair is not major, then the appliance must:

- be evacuated to at least 0 psig before it is opened if it is a high-pressure or very high-pressure appliance; or
- be pressurized to 0 psig before it is opened if it is a low-pressure appliance. Methods that require subsequent purging (e.g., nitrogen) cannot be used except with appliances containing R-113.

Appendix F

Definitions

Appliance - Any device which contains and uses a class I (CFC) or class II (HCFC) substance as a refrigerant and which is used for household or commercial purposes, including any air conditioner, refrigerator, chiller, or freezer. EPA interprets this definition to include all air-conditioning and refrigeration equipment except that designed and used exclusively for military purposes.

Certified refrigerant recovery or recycling equipment - Equipment manufactured before November 15, 1993, that meets the standards in §82.158(c), (e), or (g); equipment certified by an approved equipment testing organization to meet the standards in §82.158(b), (d), or (f); or equipment certified pursuant to §82.36(a).

Disposal - The process leading to and including:

(1) The discharge, deposit, dumping or placing of any discarded appliance into or on any land or water

(2) The disassembly of any appliance for discharge, deposit, dumping or placing of its discarded component parts into or on any land or water

(3) The disassembly of any appliance for reuse of its component parts

Follow-up verification test - Tests that involve checking the repairs within 30 days of an appliance's returning to normal operating characteristics and conditions. Follow-up verification tests for appliances from which the refrigerant charge has been evacuated means a test conducted after the appliance or portion of the appliance has resumed operation at normal operating characteristics and conditions of temperature and pressure, except in cases where sound professional judgment dictates that these tests will be more meaningful if performed prior to the return to normal operating characteristics and conditions. A follow-up verification test with respect to repairs conducted without evacuation of the refrigerant charge means a re-verification test conducted after the initial verification test and usually within 30 days of normal operating conditions. Where an appliance is not evacuated, it is only necessary to conclude any required changes in pressure, temperature or other conditions to return the appliance to normal operating characteristics and conditions.

Full charge - The amount of refrigerant required for normal operating characteristics and conditions of the appliance as determined by using one of the following four methods or a combination of one of the following four methods:

(1) The equipment manufacturers' determination of the correct full charge for the equipment;

(2) Determining the full charge by appropriate calculations based on component sizes, density of refrigerant, volume of piping, and all other relevant considerations;

(3) The use of actual measurements of the amount of refrigerant added or evacuated from the appliance; and/or

(4) The use of an established range based on the best available data, regarding the normal operating characteristics and conditions for the appliance, where the mid-point of the range will serve as the full charge, and where records are maintained in accordance with §82.166(q).

Industrial process refrigeration - Complex customized appliances used in the chemical, pharmaceutical, petrochemical and manufacturing industries. These appliances are directly linked to the industrial process. This sector also includes industrial ice machines, appliances used directly in the generation of electricity, and ice rinks. Where one appliance is used for both industrial process refrigeration and other applications, it will be considered industrial process refrigeration equipment if 50 percent or more of its operating capacity is used for industrial process refrigeration.

Initial verification test - Leak tests that are conducted as soon as practicable after a repair is completed. An initial verification test, with regard to the leak repairs that require the evacuation of the appliance or portion of the appliance, means a test conducted prior to the replacement of the full refrigerant charge and before the appliance or portion of the appliance has reached operation at normal operating characteristics and conditions of temperature and pressure. An initial verification test with regard to repairs conducted without the evacuation of the refrigerant charge means a test conducted as soon as practicable after the conclusion of the repair work.

Major maintenance, service, or repair - Maintenance, service or repair that involves removal of the appliance compressor, condenser, evaporator, or auxiliary heat exchanger coil.

Motor vehicle air conditioner (MVAC) - Any appliance that is a motor vehicle air conditioner as defined in 40 CFR part 82, subpart B.

MVAC-like appliance - Mechanical vapor compression, open-drive compressor appliances used to cool the driver's or passenger's compartment of a non-road vehicle, including agricultural and construction vehicles. This definition excludes appliances using HCFC-22.

Normal operating characteristics or conditions - Temperatures, pressures, fluid flows, speeds and other characteristics that would normally be expected for a given process load and ambient condition during operation. Normal operating characteristics and conditions are marked by the absence of atypical conditions affecting the operation of the refrigeration appliance.

Opening - Any service, maintenance, or repair on an appliance that would release class I or class II refrigerant from the appliance to the atmosphere unless the refrigerant were recovered previously from the appliance. Connecting and disconnecting hoses and gauges to and from the appliance to measure pressures within the appliance and to add refrigerant to or recover refrigerant from the appliance shall not be considered "opening."

Reclaim - To reprocess refrigerant to at least the purity specified in the ARI Standard 700-1993, Specifications for Fluorocarbon Refrigerants, and to verify this purity using the analytical methodology prescribed in the Standard. Reclamation requires specialized machinery not available at a particular job site or auto repair shop. The technician will recover the refrigerant and then send it either to a commercial reclaimer or back to the refrigerant manufacturer.

Recover - To remove refrigerant in any condition from an appliance and store it in an external container without necessarily testing or processing it in any way.

Recycle - To extract refrigerant from an appliance and clean refrigerant for reuse without meeting all of the requirements for reclamation. In general, recycled refrigerant is refrigerant that is

cleaned using oil separation and single or multiple passes through devices, such as replaceable core filter-driers, which reduce moisture, acidity, and particulate matter. Under section 609, refrigerant can be removed from one car's air conditioner, recycled on site, and then charged into a different car.

Refrigerant circuit - The parts of an appliance that are normally connected to each other (or are separated only by internal valves) and are designed to contain refrigerant.

Small appliance - Any of the following products that are fully manufactured, charged, and hermetically sealed in a factory with five pounds or less of refrigerant: refrigerators and freezers designed for home use, room air conditioners (including window air conditioners and packaged terminal air conditioners), packaged terminal heat pumps, dehumidifiers, under-the-counter ice makers, vending machines, and drinking water coolers.

Suitable replacement refrigerant - A refrigerant that is acceptable under section 612(c) of the Clean Air Act Amendments of 1990 and all regulations promulgated under that section, compatible with other materials with which it may come into contact, and able to achieve the temperatures required for the affected industrial process in a technically feasible manner.

System mothballing - The intentional shutting down of a refrigeration appliance undertaken for an extended period of time by the owners or operators of that facility, where the refrigerant has been evacuated from the appliance or the affected isolated section of the appliance, at least to atmospheric pressure.

Technician - Any person who performs maintenance, service, or repair that could reasonably be expected to release class I (CFC) or class II (HCFC) substances from appliances, except for MVACs, into the atmosphere. Technician also means any person performing disposal of appliances, except for small appliances, MVACs, and MVAC-like appliances that could be reasonably expected to release class I or class II refrigerants from appliances into the atmosphere